

# Engineering Mathematics and Statistics

## Bachelor of Science (BS)

The Engineering Mathematics and Statistics major offered through the Engineering Science Program offers students an opportunity to study pure and applied mathematics as essential components of modern engineering. By combining courses in pure mathematics, applied mathematics, statistics, the physical sciences, and engineering, a student may individualize a program of study, of theory, or of applications of both. It provides a broad foundation for graduate studies in theoretical branches of engineering, as well as in mathematics, and can prepare students for a career in specific sectors of industry or business.

## Admission to the Major

Prospective undergraduates to the College of Engineering will apply for admission to a specific program in the college. For further information, please see the College of Engineering's website (<http://coe.berkeley.edu/students/prospective-students/admissions.html>).

Admission to Engineering Science degree programs via a Change of College application for current UC Berkeley students is competitive as there are few — if any — spaces available in this major for students admitted to other colleges at UC Berkeley. For further information regarding a Change to College of Engineering, please see the College's website (<http://coe.berkeley.edu/students/current-undergraduates/change-of-college/>).

## Minor Program

There is no minor program in Engineering Mathematics and Statistics.

## Other Majors offered by the Engineering Science Program

Energy Engineering (<http://guide.berkeley.edu/undergraduate/degree-programs/energy-engineering/>) (Major and Minor)

Engineering Physics (<http://guide.berkeley.edu/undergraduate/degree-programs/engineering-physics/>) (Major)

Environmental Engineering Science (<http://guide.berkeley.edu/undergraduate/degree-programs/environmental-engineering-science/>) (Major)

In addition to the University, campus, and college requirements, students must fulfill the below requirements specific to their major program.

## General Guidelines

1. All technical courses taken in satisfaction of major requirements must be taken for a letter grade.
2. No more than one upper division course may be used to simultaneously fulfill requirements for a student's major and minor programs.
3. A minimum overall grade point average (GPA) of 2.0 is required for all work undertaken at UC Berkeley.

4. A minimum GPA of 2.0 is required for all technical courses taken in satisfaction of major requirements.

For information regarding residence requirements and unit requirements, please see the College Requirements tab.

For a detailed plan of study by year and semester, please see the Plan of Study tab.

## Lower Division Major Requirements

MATH 1A	Calculus	4
MATH 1B	Calculus	4
MATH 53	Multivariable Calculus	4
MATH 54	Linear Algebra and Differential Equations	4
CHEM 4A	General Chemistry and Quantitative Analysis <sup>1</sup>	5
or CHEM 1A & 1AL	General Chemistry and General Chemistry Laboratory	
PHYSICS 7A	Physics for Scientists and Engineers	4
PHYSICS 7B	Physics for Scientists and Engineers	4
PHYSICS 7C	Physics for Scientists and Engineers	4
ENGIN 7	Introduction to Computer Programming for Scientists and Engineers	4
or COMPSCI 61A	The Structure and Interpretation of Computer Programs	
ENGIN 177	Advanced Programming with MATLAB	3-4
or COMPSCI 6	Data Structures	
or COMPSCI 6	Data Structures and Programming Methodology	
Lower division technical electives		
Select two from the following: <sup>2</sup>		
COMPSCI C8	Foundations of Data Science [4]	
COMPSCI 61A	The Structure and Interpretation of Computer Programs [4] <sup>3</sup>	
COMPSCI 61B	Data Structures [4] <sup>3</sup>	
or COMPSCI 61B	Data Structures and Programming Methodology	
COMPSCI 61C	Great Ideas of Computer Architecture (Machine Structures) [4]	
or COMPSCI 61C	Machine Structures (Lab-Centric)	
COMPSCI 70	Discrete Mathematics and Probability Theory [4]	
EECS 16A	Designing Information Devices and Systems I [4]	
EECS 16B	Designing Information Devices and Systems II [4]	
ENGIN 7	Introduction to Computer Programming for Scientists and Engineers [4] <sup>3</sup>	
ENGIN 29	Manufacturing and Design Communication [4]	
MAT SCI 45 & 45L	Properties of Materials and Properties of Materials Laboratory	
MATH 55	Discrete Mathematics [4]	
MEC	Introduction to Solid Mechanics [3]	
ENG C85/		
CIV ENG C30		

<sup>1</sup> CHEM 4A is intended for students majoring in chemistry or a closely-related field.

<sup>2</sup> Other courses may be used if approved by a faculty adviser.

<sup>3</sup> This course may only be used as a lower division technical elective if not being used to satisfy other requirements above.

## Upper Division Requirements

Due to the interdisciplinary nature of this major, electives must be selected and approved in consultation with a faculty adviser.

MATH 110	Linear Algebra	4
MATH 104	Introduction to Analysis	4
MATH 105	Second Course in Analysis	4
or MATH 185	Introduction to Complex Analysis	
MATH 128A	Numerical Analysis	4
STAT 134	Concepts of Probability	4
or EECS 126	Probability and Random Processes	
or STAT C140	Probability for Data Science	
or IND ENG 17P	Probability and Risk Analysis for Engineers	
Select three math/statistics technical electives		10-12
Select one course in mathematics, one course in statistics, and one course from either, from the following:		
MATH H104	Honors Introduction to Analysis [4]	
MATH 105	Second Course in Analysis [4]	
MATH H113	Honors Introduction to Abstract Algebra [4]	
MATH 113	Introduction to Abstract Algebra [4]	
MATH 114	Second Course in Abstract Algebra [4]	
MATH 115	Introduction to Number Theory [4]	
MATH 116	Cryptography [4]	
MATH 118	Fourier Analysis, Wavelets, and Signal Processing [4]	
MATH 121A	Mathematical Tools for the Physical Sciences [4]	
MATH 121B	Mathematical Tools for the Physical Sciences [4]	
MATH 123	Ordinary Differential Equations [4]	
MATH 124	Programming for Mathematical Applications [4]	
MATH 126	Introduction to Partial Differential Equations [4]	
MATH 127	Mathematical and Computational Methods in Molecular Biology [4]	
MATH 128B	Numerical Analysis [4]	
MATH 130	Groups and Geometries [4]	
MATH 136	Incompleteness and Undecidability [4]	
MATH 140	Metric Differential Geometry [4]	
MATH 141	Elementary Differential Topology [4]	
MATH 142	Elementary Algebraic Topology [4]	
MATH 143	Elementary Algebraic Geometry [4]	
MATH 151	Mathematics of the Secondary School Curriculum I [4]	
MATH 152	Mathematics of the Secondary School Curriculum II [4]	
MATH 170	Mathematical Methods for Optimization [4]	
MATH 172	Combinatorics [4]	
MATH H185	Honors Introduction to Complex Analysis [4]	
MATH 185	Introduction to Complex Analysis [4]	
MATH 189	Mathematical Methods in Classical and Quantum Mechanics [4]	
ENGIN 117	Methods of Engineering Analysis [3] (counts as a Math Elective)	
STAT 135	Concepts of Statistics [4]	
STAT 150	Stochastic Processes [3]	
STAT 151A	Linear Modelling: Theory and Applications [4]	

STAT 152	Sampling Surveys [4]
STAT 153	Introduction to Time Series [4]
STAT 154	Modern Statistical Prediction and Machine Learning [4]
STAT 157	Seminar on Topics in Probability and Statistics [3]
STAT 158	Experimental Design [4]

Additional upper division technical electives: select 16 units of upper division engineering courses, in consultation with faculty adviser<sup>1</sup>

<sup>1</sup> Technical electives must include 16 units of upper division engineering courses, selected in consultation with the student's faculty adviser, in order to provide depth in an area of engineering with high mathematical content—typically, most of these courses will come from a single engineering department, but courses that complement each other from different departments are also permissible. Engineering courses cannot include: any course taken on a P/NP basis; BIO ENG 100, DES INV courses (except DES INV 190E), ENGIN 125, ENGIN 157AC, ENGIN 180, ENGIN 183 series, ENGIN 185, ENGIN 187, ENGIN 195 series, IND ENG 172, IND ENG 185, IND ENG 186, IND ENG 190 series, IND ENG 191, IND ENG 192, IND ENG 195, MEC ENG 190K, 191AC, 191K. Graded research units (such as H194 or 196) are reviewed on a case by case basis and may be petitioned.

## Students in the College of Engineering must complete no fewer than 120 semester units with the following provisions:

1. Completion of the requirements of one engineering major program (<https://engineering.berkeley.edu/students/undergraduate-guide/degree-requirements/major-programs/>) of study.
2. A minimum overall grade point average of 2.00 (C average) and a minimum 2.00 grade point average in upper division technical coursework required of the major.
3. The final 30 units and two semesters must be completed in residence in the College of Engineering on the Berkeley campus.
4. All technical courses (math, science, and engineering) that can fulfill requirements for the student's major must be taken on a letter graded basis (unless they are only offered P/NP).
5. Entering freshmen are allowed a maximum of eight semesters to complete their degree requirements. Entering junior transfers are allowed five semesters to complete their degree requirements. Summer terms are optional and do not count toward the maximum. Students are responsible for planning and satisfactorily completing all graduation requirements within the maximum allowable semesters.
6. Adhere to all college policies and procedures (<https://engineering.berkeley.edu/students/undergraduate-guide/policies-procedures/>) as they complete degree requirements.
7. Complete the lower division program before enrolling in upper division engineering courses.

## Humanities and Social Sciences (H/SS) Requirement

To promote a rich and varied educational experience outside of the technical requirements for each major, the College of Engineering has a six-course Humanities and Social Sciences breadth requirement (<http://engineering.berkeley.edu/student-services/degree-requirements/humanities-and-social-sciences/>), which must be completed to graduate. This requirement, built into all the engineering programs of

study, includes two Reading and Composition courses (R&C), and four additional courses within which a number of specific conditions must be satisfied. See the humanities and social sciences (<https://engineering.berkeley.edu/students/undergraduate-guide/degree-requirements/humanities-and-social-sciences/>) section of our website for details.

## Class Schedule Requirements

- Minimum units per semester: 12.0
- Maximum units per semester: 20.5
- Minimum technical courses: College of Engineering undergraduates must include at least two letter graded technical courses (of at least 3 units each) in their semester program. Every semester students are expected to make satisfactory progress in their declared major. Satisfactory progress is determined by the student's Engineering Student Services Advisor. (Note: For most majors, normal progress (<https://engineering.berkeley.edu/academics/undergraduate-guide/policies-procedures/scholarship-progress/#ac12282>) will require enrolling in 3-4 technical courses each semester). Students who are not in compliance with this policy by the end of the fifth week of the semester are subject to a registration block that will delay enrollment for the following semester.
- All technical courses (math, science, engineering) that satisfy requirements for the major must be taken on a letter-graded basis (unless only offered as P/NP).

## Minimum Academic (Grade) Requirements

- Minimum overall and semester grade point averages of 2.00 (C average) are required of engineering undergraduates. Students will be subject to dismissal from the University if during any fall or spring semester their overall UC GPA falls below a 2.00, or their semester GPA is less than 2.00.
- Students must achieve a minimum grade point average of 2.00 (C average) in upper division technical courses required for the major curriculum each semester.
- A minimum overall grade point average of 2.00 and a minimum 2.00 grade point average in upper division technical course work required for the major are required to earn a Bachelor of Science in the College of Engineering.

## Unit Requirements

To earn a Bachelor of Science in Engineering, students must complete at least 120 semester units of courses subject to certain guidelines:

- Completion of the requirements of one engineering major program (<https://engineering.berkeley.edu/students/undergraduate-guide/degree-requirements/major-programs/>) of study.
- A maximum of 16 units of special studies coursework (courses numbered 97, 98, 99, 197, 198, or 199) is allowed to count towards the B.S. degree, and no more than 4 units in any single term can be counted.
- A maximum of 4 units of physical education from any school attended will count towards the 120 units.
- Passed (P) grades may account for no more than one third of the total units completed at UC Berkeley, Fall Program for Freshmen (FPF), UC Education Abroad Program (UCEAP), or UC Berkeley Washington Program (UCDC) toward the 120 overall minimum unit requirement. Transfer credit is not factored into the limit. This includes transfer units from outside of the UC system, other UC

campuses, credit-bearing exams, as well as UC Berkeley Extension XB units.

## Normal Progress

Students in the College of Engineering must enroll in a full-time program and make normal progress (<https://engineering.berkeley.edu/students/undergraduate-guide/policies-procedures/scholarship-progress/#ac12282>) each semester toward the bachelor's degree. The continued enrollment of students who fail to achieve minimum academic progress shall be subject to the approval of the dean. (Note: Students with official accommodations established by the Disabled Students' Program, with health or family issues, or with other reasons deemed appropriate by the dean may petition for an exception to normal progress rules.)

## University of California Requirements

Entry Level Writing (<http://guide.berkeley.edu/undergraduate/education/#earningyourdegreertext>)

All students who will enter the University of California as freshmen must demonstrate their command of the English language by satisfying the Entry Level Writing Requirement (ELWR). The UC Entry Level Writing Requirement website (<https://admission.universityofcalifornia.edu/elwr/requirements/test-scores-grades.html>) provides information on how to satisfy the requirement

American History and American Institutions (<http://guide.berkeley.edu/undergraduate/education/#earningyourdegreertext>)

The American History and Institutions (AH&I) requirements are based on the principle that a US resident graduated from an American university should have an understanding of the history and governmental institutions of the United States.

## Campus Requirement

American Cultures (<http://guide.berkeley.edu/undergraduate/education/#earningyourdegreertext>)

The American Cultures requirement is a Berkeley campus requirement, one that all undergraduate students at Berkeley need to pass in order to graduate. You satisfy the requirement by passing, with a grade not lower than C- or P, an American Cultures course. You may take an American Cultures course any time during your undergraduate career at Berkeley. The requirement was instituted in 1991 to introduce students to the diverse cultures of the United States through a comparative framework. Courses are offered in more than fifty departments in many different disciplines at both the lower and upper division level.

For more detailed information regarding the courses listed below (e.g., elective information, GPA requirements, etc.), please see the College Requirements and Major Requirements tabs.

	Fall Units	Freshman Spring Units	
CHEM 4A or 1A <b>and</b> 1AL <sup>1</sup>		5 MATH 1B	4
MATH 1A		4 PHYSICS 7A	4
Reading & Composition Part A Course <sup>5</sup>		4 ENGIN 7 or COMPSCI 61A	4
Humanities/Social Sciences Course <sup>5</sup>		3-4 First Lower Division Technical Elective <sup>2</sup>	3-4

Sophomore			
	Fall Units	Spring Units	
MATH 53		4 MATH 54	4
PHYSICS 7B		4 PHYSICS 7C	4
Second Lower Division Technical Elective <sup>2</sup>		3-4 ENGIN 177, COMPSCI 61B, or COMPSCI 61BL	3-4
Reading & Composition Part B Course <sup>5</sup>		4 Humanities/ Social Sciences Course <sup>5</sup>	3-4
<b>15-16</b>		<b>14-16</b>	
Junior			
	Fall Units	Spring Units	
MATH 104		4 MATH 105 or 185	4
MATH 110		4 MATH 128A	4
STAT 134, EECS 126, IND ENG 172, or STAT C140		4 Upper Division Technical Elective <sup>3,4</sup>	4
Humanities/Social Science Course <sup>5</sup>		3-4 Humanities/ Social Science Course <sup>5</sup>	3-4
<b>15-16</b>		<b>15-16</b>	
Senior			
	Fall Units	Spring Units	
Upper Division Technical Electives <sup>3,4</sup>		10-12 Upper Division Technical Electives <sup>3,4</sup>	12
Free Electives		4-5 Free Electives	4-5
<b>14-17</b>		<b>16-17</b>	
<b>Total Units: 120-131</b>			

<sup>1</sup> CHEM 4A is intended for students majoring in chemistry or a closely-related field.

<sup>2</sup> Two lower division courses in engineering, mathematics, or statistics, chosen in consultation with the faculty adviser; options include CIV ENG C30/MEC ENG C85, COMPSCI C8, COMPSCI 61A, COMPSCI 61B, COMPSCI 61BL, COMPSCI 61C, COMPSCI 61CL, COMPSCI 70, ENGIN 7, ENGIN 29, MAT SCI 45 plus MAT SCI 45L, MATH 55, but other courses may also be used if approved by a faculty adviser. Courses used to satisfy the two computer science course requirements may NOT also be used for lower division technical electives. They can only be used to complete one requirement.

<sup>3</sup> Technical electives must include 16 units of upper division engineering courses, selected in consultation with the student's faculty adviser, in order to provide depth in an area of engineering with high mathematical content—typically, most of these courses will come from a single engineering department, but courses that complement each other from different departments are also permissible. Engineering courses cannot include: any course taken on a P/NP basis; BIO ENG 100, DES INV courses (except DES INV 190E), ENGIN 125, ENGIN 157AC, ENGIN 180, ENGIN 183 series, ENGIN 185, ENGIN 187, ENGIN 195 series, IND ENG 172, IND ENG 185, IND ENG 186, IND ENG 190 series, IND ENG 191, IND ENG 192, IND ENG 195, MEC ENG 190K, MEC ENG 191AC, MEC ENG 191K. Graded research units (such as H194 or 196) are reviewed on a case by case basis and may be petitioned.

<sup>4</sup> Three additional upper division technical courses as follows: One in mathematics, one in statistics and one from either math or statistics

from among: all upper division Math courses (except MATH C103, 125A, 135, 160, and any course numbered 191 or higher) and ENGIN 117 (counts as a math elective); STAT 135, STAT 150, STAT 151A, STAT 152, STAT 153, STAT 154, STAT 157, STAT 158.

<sup>5</sup> The Humanities/Social Sciences (H/SS) requirement includes two approved Reading & Composition (R&C) courses and four additional approved courses, with which a number of specific conditions must be satisfied. R&C courses must be taken for a letter grade (C- or better required). The first half (R&C Part A) must be completed by the end of the freshman year; the second half (R&C Part B) must be completed by no later than the end of the sophomore year. The remaining courses may be taken at any time during the program. See [engineering.berkeley.edu/hss](https://engineering.berkeley.edu/hss) (<https://engineering.berkeley.edu/academics/undergraduate-guide/degree-requirements/humanities-and-social-sciences/>) for complete details and a list of approved courses.

Major Maps help undergraduate students discover academic, co-curricular, and discovery opportunities at UC Berkeley based on intended major or field of interest. Developed by the Division of Undergraduate Education in collaboration with academic departments, these experience maps will help you:

- **Explore** your major and gain a better understanding of your field of study
- **Connect** with people and programs that inspire and sustain your creativity, drive, curiosity and success
- **Discover** opportunities for independent inquiry, enterprise, and creative expression
- **Engage** locally and globally to broaden your perspectives and change the world
- **Reflect** on your academic career and prepare for life after Berkeley

Use the major map below as a guide to planning your undergraduate journey and designing your own unique Berkeley experience.

View the Engineering Mathematics and Statistics Major Map PDF. ([https://ue.berkeley.edu/sites/default/files/engineering\\_science.pdf](https://ue.berkeley.edu/sites/default/files/engineering_science.pdf))

## Engineering Mathematics and Statistics

Expand all course descriptions [+]  
Collapse all course descriptions [-]

## ENGIN 1 Engineering Your Life: Skills for Leadership, Discovery and Service 1 Unit

Terms offered: Spring 2023, Spring 2022, Spring 2021

This course provides the framework for engineering an empowered life through leadership, discovery and service. The class focuses on development of self, emotional intelligence, strategic thinking, problem solving, teamwork, diversity, and service learning. Skills include developing of self-awareness; understanding our unique strengths; debunking the imposter syndrome; creating plans of action and setting goals; giving and receiving assessments; interpreting body language; managing time and life-balance; and creating mission statements. Teamwork skills include methods for inspiring others; variations in leadership styles and team dynamics; rhythm of action for projects and teams; difficult conversations and conflict resolution; mechanisms. Engineering Your Life: Skills for Leadership, Discovery and Service: Read More [+]

### Objectives & Outcomes

**Course Objectives:** This course offers the requisite framework for engineering an empowered life. The course provides students with requisite skills for authentic leadership, self-discovery and societal service. These attributes are in alignment with the mission of the College of Engineering and the Berkeley campus.

**Student Learning Outcomes:** Students will learn how to assess personal strengths, implement plans of action and develop mission statements. Students will learn how to optimize their knowledge with assessment of learning styles along with key communication tools necessary for conflict resolution and inspiration of others (teamwork). Through a series of active exercises and self-reflection activities the students will learn requisite skills for self-discovery and the creation of a personal leadership plan.

### Rules & Requirements

**Prerequisites:** Designed for engineering freshmen, the class is open to all students in the College of Engineering or by permission of instructor

### Hours & Format

**Fall and/or spring:** 15 weeks - 1 hour of lecture per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Offered for pass/not pass grade only. Alternative to final exam.

**Instructor:** Pruitt

Engineering Your Life: Skills for Leadership, Discovery and Service: Read Less [-]

## ENGIN 7 Introduction to Computer Programming for Scientists and Engineers 4 Units

Terms offered: Spring 2023, Fall 2022, Summer 2022 10 Week Session  
Elements of procedural and object-oriented programming. Induction, iteration, and recursion. Real functions and floating-point computations for engineering analysis. Introduction to data structures. Representative examples are drawn from mathematics, science, and engineering. The course uses the MATLAB programming language. Sponsoring departments: Civil and Environmental Engineering and Mechanical Engineering.

Introduction to Computer Programming for Scientists and Engineers: Read More [+]

### Rules & Requirements

**Prerequisites:** MATH 1B (may be taken concurrently)

**Credit Restrictions:** Students will receive no credit for Engineering 7 after completing Engineering W7. A deficient grade in Engineering W7 may be repeated by taking Engineering 7.

### Hours & Format

**Fall and/or spring:** 15 weeks - 2 hours of lecture, 1 hour of discussion, and 4 hours of laboratory per week

**Summer:** 10 weeks - 3 hours of lecture, 1.5 hours of discussion, and 6 hours of laboratory per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Formerly known as:** 77

Introduction to Computer Programming for Scientists and Engineers: Read Less [-]

## ENGIN W7 Introduction to Computer Programming for Scientists and Engineers 4 Units

Terms offered: Summer 2021 10 Week Session, Summer 2016 10 Week Session, Summer 2015 10 Week Session

Elements of procedural and object-oriented programming. Induction, iteration, and recursion. Real functions and floating-point computations for engineering analysis. Introduction to data structures. Representative examples are drawn from mathematics, science, and engineering. The course uses the MATLAB programming language.

Introduction to Computer Programming for Scientists and Engineers:

Read More [+]

### Rules & Requirements

**Prerequisites:** MATH 1B (may be taken concurrently)

**Credit Restrictions:** Students will receive no credit for Engineering W7 after completing Engineering 7 or 77. A deficient grade in Engineering 7 or 77 may be removed by taking Engineering W7.

### Hours & Format

**Fall and/or spring:** 15 weeks - 2 hours of web-based lecture, 4 hours of laboratory, and 1 hour of web-based discussion per week

**Summer:** 10 weeks - 6 hours of web-based lecture, 0 hours of laboratory, and 7.5 hours of web-based discussion per week

**Online:** This is an online course.

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructor:** Papadopoulos

Introduction to Computer Programming for Scientists and Engineers:

Read Less [-]

## ENGIN 11 A Hands-on Introduction to Radiation Detection: Getting to know our Radioactive World 3 Units

Terms offered: Spring 2023, Fall 2021, Fall 2020

Introduction to basic concepts in radiation detection and radioactivity, electrical circuits, and data analytics. Lectures provide the theoretical foundation of the work being performed in the accompanying laboratory. The course will contain three sections: introduction to how radiation interacts with matter and radiation detection technologies; development of the tools (mathematical and computational) needed for analyzing various types of radiation and environmental data; and building of a basic radiation sensor system.

A Hands-on Introduction to Radiation Detection: Getting to know our Radioactive World: Read More [+]

### Objectives & Outcomes

**Course Objectives:** The course is suitable for Nuclear Engineering students, other Engineering majors, and any students interested in gaining a general understanding of radiation detection.

The focus of this course will be on the application of the nuclear science, radiation detection, and data analysis concepts covered to the building of a multi-sensor radiation detection system, following a template for the required data acquisition software and circuit integration.

Fieldwork related to a chosen research topic will be carried out in small groups, with group oral presentations and final reports. Students will be introduced to research opportunities on campus and at nearby lab facilities through tours of lab spaces throughout the department and field trips to LBNL and LLNL.

Students will be introduced to core concepts in nuclear science, statistical analysis, and computation, while being given practical experience applying those concepts to radiation detection and data analysis.

The objective of this course is to provide Freshman and Sophomore students with an introduction to the fundamentals of nuclear radiation and radiation detection through a hands-on approach.

**Student Learning Outcomes:** Be able to outline and carry out a research project, prepare written and oral presentations of that work, and demonstrate how the sensors they built work.

By the end of this course, students should be able to: Identify types of radioactivity, radiation detection methods and sources of environmental radiation,

Create simple circuit designs making use of standard circuitry components, demonstrate basic soldering skills, and demonstrate a familiarity with printed circuit board design tools,

Make use of software tools including the Python programming language, version control with git, and shell environments,

Perform statistical analysis of large data sets and quantify statistical and systematic uncertainties in experimental data,

### Rules & Requirements

**Credit Restrictions:** Students will receive no credit for ENGIN 11 after completing ENGIN 11. A deficient grade in ENGIN 11 may be removed by taking ENGIN 11.

### Hours & Format

**Fall and/or spring:** 15 weeks - 1 hour of lecture and 3 hours of laboratory per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Alternative to final exam.

## ENGIN 24 Freshman Seminar 1 Unit

Terms offered: Spring 2023, Fall 2022, Spring 2022

The Berkeley Seminar Program is designed to provide students with the opportunity to explore an intellectual topic with a faculty member in a small seminar setting. Berkeley Seminars are offered in all college departments, and topics vary from department to department and semester to semester.

Freshman Seminar: Read More [+]

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit when topic changes.

### Hours & Format

**Fall and/or spring:** 15 weeks - 1 hour of lecture per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** The grading option will be decided by the instructor when the class is offered. Final exam required.

Freshman Seminar: Read Less [-]

## ENGIN 25 Visualization for Design 2 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019

Development of 3-dimensional visualization skills for engineering design. Sketching as a tool for design communication. Presentation of 3-dimensional geometry with 2-dimensional engineering drawings. This course will introduce the use of 2-dimensional CAD on computer workstations as a major graphical analysis and design tool. A group design project is required. Teamwork and effective communication are emphasized.

Visualization for Design: Read More [+]

### Objectives & Outcomes

**Course Objectives:** Improve 3-dimensional visualization skills; enable a student to create and understand engineering drawings; introduce 2-dimensional computer-aided geometry modeling as a visualization, design, and analysis tool; enhance critical thinking and design skills; emphasize communication skills, both written and oral; develop teamwork skills; offer experience in hands-on engineering projects; develop early abilities in identifying, formulating, and solving engineering problems; introduce students to the societal context of engineering practice.

**Student Learning Outcomes:** Upon completion of the course, students shall be able to communicate 3-dimensional geometry effectively using sketches; operate 2-dimensional CAD software with a high degree of skill and confidence; understand and create engineering drawings; visualize 3-dimensional geometry from a series of 2-dimensional drawings.

### Hours & Format

**Fall and/or spring:** 15 weeks - 1 hour of lecture and 2 hours of laboratory per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructors:** Lieu, McMains

Visualization for Design: Read Less [-]

## ENGIN 26 Three-Dimensional Modeling for Design 2 Units

Terms offered: Spring 2023, Fall 2022, Spring 2022

Three-dimensional modeling for engineering design. This course will emphasize the use of CAD on computer workstations as a major graphical analysis and design tool. Students develop design skills, and practice applying these skills. A group design project, design and fabrication (3D print) of the tower and rotor is required. Hands-on creativity, teamwork, and effective communication are emphasized.

Three-Dimensional Modeling for Design: Read More [+]

### Objectives & Outcomes

**Course Objectives:** Develop teamwork skills; offer experience in hands-on, creative engineering projects.

Enhance critical thinking and design skills; emphasize communication skills, both written and oral.

Introduce computer-based solid, parametric, and assembly modeling as a tool for engineering design.

Reinforce the societal context of engineering practice; develop early abilities in identifying, formulating, and solving engineering problems.

**Student Learning Outcomes:** Create a 3D solid model of a complicated object with high degree of confidence.

Extract 2D orthographic views from the 3D model for fabrication.

Extract section and auxiliary views.

Specify the proper dimensions, according to industry standards, for parts to be fabricated.

Understand the basics of assembly and associative constraints.

Understand the basics of rapid prototyping, in particular 3D printing.

Understand the engineering design process and the implementation of different design phases.

Work effectively as a member of a design team.

### Hours & Format

**Fall and/or spring:** 15 weeks - 1 hour of lecture and 2 hours of laboratory per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructors:** Youssefi, McMains

Three-Dimensional Modeling for Design: Read Less [-]

## ENGIN 27 Introduction to Manufacturing and Tolerancing 2 Units

Terms offered: Summer 2021 10 Week Session, Fall 2020, Summer 2020 10 Week Session

Geometric dimensioning and tolerancing (GD&T), tolerance analysis for fabrication, fundamentals of manufacturing processes (metal cutting, welding, joining, casting, molding, and layered manufacturing).

Introduction to Manufacturing and Tolerancing: Read More [+]

### Objectives & Outcomes

**Course Objectives:** Enable a student to create and understand tolerances in engineering drawings; enhance critical thinking and design skills; emphasize communication skills, both written and oral; offer hands-on experience in manufacturing; develop abilities in identifying, formulating, and solving engineering problems; introduce students to the context of engineering practice.

**Student Learning Outcomes:** Upon completion of the course, students shall be able to fabricate basic parts in the machine shop; understand and communicate tolerance requirements in engineering drawings using industry standard GD&T; use metrology tools to evaluate if physical parts are within specified tolerances; demonstrate familiarity with manufacturing processes; and design parts that can be fabricated realistically and economically using these processes.

### Rules & Requirements

**Prerequisites:** ENGIN 25 (may be taken concurrently)

### Hours & Format

**Fall and/or spring:** 15 weeks - 1 hour of lecture and 2 hours of laboratory per week

**Summer:** 10 weeks - 1.5 hours of lecture and 3 hours of laboratory per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructors:** McMains, Lieu, Taylor

Introduction to Manufacturing and Tolerancing: Read Less [-]



## ENGIN 29 Manufacturing and Design Communication 4 Units

Terms offered: Spring 2023, Fall 2022, Summer 2022 10 Week Session

An introduction to manufacturing process technologies and the ways in which dimensional requirements for manufactured objects are precisely communicated, especially through graphical means. Fundamentals of cutting, casting, molding, additive manufacturing, and joining processes are introduced. Geometric dimensioning and tolerancing (GD&T), tolerance analysis for fabrication, concepts of process variability, and metrology techniques are introduced and practiced. 3-D visualization skills for engineering design are developed via sketching and presentation of 3-D geometries with 2-D engineering drawings. Computer-aided design software is used. Teamwork and effective communication are emphasized through lab activities and a design project.

Manufacturing and Design Communication: Read More [+]

### Objectives & Outcomes

**Course Objectives:** Develop early abilities in identifying, formulating, and solving engineering problems.

Emphasize communication skills, both written and oral; develop teamwork skills.

Enable a student to create and understand tolerances in engineering drawings.

Enhance critical thinking and design skills.

Improve 3-dimensional visualization skills; enable a student to create and understand engineering drawings.

Introduce 2-dimensional computer-aided geometry modeling as a visualization, design, and analysis tool.

Introduce students to the societal context of engineering practice.

Offer an experience in hands-on engineering projects.

**Student Learning Outcomes:** A knowledge of contemporary issues.

A recognition of the need for, and an ability to engage in life-long learning.

An ability to apply knowledge of mathematics, science, and engineering.

An ability to communicate effectively.

An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

An ability to design and conduct experiments, as well as to analyze and interpret data.

An ability to identify, formulate, and solve engineering problems.

An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

An understanding of professional and ethical responsibility.

### Rules & Requirements

**Prerequisites:** ENGIN 26 or equivalent experience in three-dimensional solid modeling (e.g. Solidworks, Fusion 360) is recommended

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture and 3 hours of laboratory per week

**Summer:** 10 weeks - 4.5 hours of lecture and 4.5 hours of laboratory per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Alternative to final exam.

**Instructors:** Taylor, Hayden, McMains, Sarah, Stuart, Hannah

## ENGIN 39B Freshman/Sophomore Seminar 1.5 - 4 Units

Terms offered: Spring 2010, Spring 2009, Spring 2008

Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small-seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollment limits are set by the faculty, but the suggested limit is 25.

Freshman/Sophomore Seminar: Read More [+]

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 1.5-4 hours of seminar per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** The grading option will be decided by the instructor when the class is offered. Final exam required.

Freshman/Sophomore Seminar: Read Less [-]

## ENGIN 39E Freshman/Sophomore Seminar 1.5 - 4 Units

Terms offered: Spring 2010, Spring 2009, Spring 2008

Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small-seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollment limits are set by the faculty, but the suggested limit is 25.

Freshman/Sophomore Seminar: Read More [+]

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 1.5-4 hours of seminar per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** The grading option will be decided by the instructor when the class is offered. Final exam required.

Freshman/Sophomore Seminar: Read Less [-]

## ENGIN 39F Freshman/Sophomore Seminar 1.5 - 4 Units

Terms offered: Fall 2010

Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small-seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollment limits are set by the faculty, but the suggested limit is 25.

Freshman/Sophomore Seminar: Read More [+]

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 1.5-4 hours of seminar per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** The grading option will be decided by the instructor when the class is offered. Final exam required.

Freshman/Sophomore Seminar: Read Less [-]

## ENGIN 40 Engineering Thermodynamics 4 Units

Terms offered: Fall 2022, Fall 2021, Fall 2020

Fundamental laws of thermodynamics for simple substances; application to flow processes and to nonreacting mixtures; statistical thermodynamics of ideal gases and crystalline solids; chemical and materials thermodynamics; multiphase and multicomponent equilibria in reacting systems; electrochemistry. Sponsoring Departments: Materials Science and Engineering and Nuclear Engineering.

Engineering Thermodynamics: Read More [+]

### Rules & Requirements

**Prerequisites:** PHYSICS 7B and MATH 54. CHEM 1B recommended

**Credit Restrictions:** Students will receive no credit for Engineering 40 after taking Engineering 115, Chemical Engineering 141 or Mechanical Engineering 40.

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture and 1 hour of discussion per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructors:** Bolind, Persson

Engineering Thermodynamics: Read Less [-]

## ENGIN 47 Supplementary Work in Lower Division Engineering 1 - 3 Units

Terms offered: Spring 2022, Fall 2016, Fall 2012

May be taken only with permission of the Dean of the College of Engineering. Students with partial credit in a lower division engineering course may complete the work under this heading.

Supplementary Work in Lower Division Engineering: Read More [+]

### Rules & Requirements

**Prerequisites:** Limited to students who must make up a fraction of a required lower division course

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 0 hours of independent study per week

**Summer:** 8 weeks - 1.5-5.5 hours of independent study per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

Supplementary Work in Lower Division Engineering: Read Less [-]

## ENGIN 92 Perspectives in Engineering 1 Unit

Terms offered: Fall 2022, Fall 2021, Fall 2020

This series of lectures provides students, especially undeclared Engineering students, with information on the various engineering disciplines to guide them toward choice of major. Lecturers describe research activities, how they made their own career choices, and indicate future opportunities. Recommended for all Engineering Science students and required for Engineering undeclared students.

Perspectives in Engineering: Read More [+]

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 1 hour of lecture per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Offered for pass/not pass grade only. Final exam not required.

Perspectives in Engineering: Read Less [-]

## ENGIN 93 Energy Engineering Seminar 1 Unit

Terms offered: Fall 2022, Fall 2021, Fall 2020

Weekly seminar with different speakers on energy-related topics. The goal is to expose students to a broad range of energy issues.

Energy Engineering Seminar: Read More [+]

### Hours & Format

**Fall and/or spring:** 15 weeks - 1 hour of seminar per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Offered for pass/not pass grade only. Final exam not required.

**Instructor:** Zohdi

Energy Engineering Seminar: Read Less [-]

## ENGIN 98 Directed Group Studies for Lower Division Undergraduates 1 - 4 Units

Terms offered: Spring 2023, Fall 2022, Spring 2022

Seminars for group study of selected topics, which will vary from year to year. Intended for students in the lower division.

Directed Group Studies for Lower Division Undergraduates: Read More [+]

### Rules & Requirements

**Prerequisites:** Consent of instructor

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 1-4 hours of directed group study per week

### Summer:

6 weeks - 2.5-10 hours of directed group study per week

8 weeks - 1.5-7.5 hours of directed group study per week

10 weeks - 1.5-6 hours of directed group study per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Offered for pass/not pass grade only. Final exam not required.

Directed Group Studies for Lower Division Undergraduates: Read Less [-]

## ENGIN 117 Methods of Engineering Analysis 3 Units

Terms offered: Fall 2019, Fall 2017, Fall 2015

Methods of theoretical engineering analysis; techniques for analyzing partial differential equations and the use of special functions related to engineering systems. Sponsoring Department: Mechanical Engineering. Methods of Engineering Analysis: Read More [+]

### Rules & Requirements

**Prerequisites:** MATH 53 and MATH 54

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture and 1 hour of discussion per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

Methods of Engineering Analysis: Read Less [-]

## ENGIN 120 Principles of Engineering Economics 3 Units

Terms offered: Fall 2022, Spring 2022, Fall 2021

Economic analysis for engineering decision making: Capital flows, effect of time and interest rate. Different methods of evaluation of alternatives. Minimum-cost life and replacement analysis. Depreciation and taxes. Uncertainty; preference under risk; decision analysis. Capital sources and their effects. Economic studies.

Principles of Engineering Economics: Read More [+]

### Rules & Requirements

**Prerequisites:** Completion of 60 units of an approved engineering curriculum

**Credit Restrictions:** Students will receive no credit for Engineering 120 after taking Industrial Engineering 120.

### Hours & Format

**Fall and/or spring:** 15 weeks - 2 hours of lecture and 1 hour of discussion per week

**Summer:** 8 weeks - 4 hours of lecture and 2 hours of discussion per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructor:** Adler

Principles of Engineering Economics: Read Less [-]

## ENGIN 125 Ethics, Engineering, and Society 3 Units

Terms offered: Spring 2023, Spring 2022, Spring 2021

How should engineers analyze and resolve the ethical issues inherent in engineering? This seminar-style course provides an introduction to how theories, concepts, and methods from the humanities and social science can be applied to ethical problems in engineering. Assignments incorporate group and independent research designed to provide students an opportunity to contribute novel findings to the emerging field of engineering ethics while building their analytical and communication skills. This course cannot be used to fulfill any engineering technical requirements (units or courses).

Ethics, Engineering, and Society: Read More [+]

### Hours & Format

**Fall and/or spring:** 15 weeks - 2 hours of lecture and 1 hour of discussion per week

### Summer:

6 weeks - 5 hours of lecture and 3 hours of discussion per week

8 weeks - 4 hours of lecture and 2 hours of discussion per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam not required.

Ethics, Engineering, and Society: Read Less [-]

## ENGIN 128 Advanced Engineering Design Graphics 3 Units

Terms offered: Fall 2022, Fall 2021, Fall 2020

Advanced graphics tools for engineering design. Parametric solid modeling. Assembly modeling. Presentation using computer animation and multimedia techniques.

Advanced Engineering Design Graphics: Read More [+]

### Rules & Requirements

**Prerequisites:** ENGIN 26

### Hours & Format

**Fall and/or spring:** 15 weeks - 2 hours of lecture and 3 hours of laboratory per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam not required.

**Instructor:** Lieu

Advanced Engineering Design Graphics: Read Less [-]

## ENGIN 147 Supplementary Work in Upper Division Engineering 1 - 3 Units

Terms offered: Fall 2016, Fall 2015, Spring 2015

May be taken only with permission of the Dean of the College of Engineering. Students with partial credit in an upper division engineering course may complete the work under this heading.

Supplementary Work in Upper Division Engineering: Read More [+]

### Rules & Requirements

**Prerequisites:** Limited to students who must make up a fraction of a required upper division course

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 0 hours of independent study per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

Supplementary Work in Upper Division Engineering: Read Less [-]

## ENGIN 150 Basic Modeling and Simulation Tools for Industrial Research Applications 4 Units

Terms offered: Fall 2021, Fall 2019, Fall 1997

The course emphasizes elementary modeling, numerical methods & their implementation on physical problems motivated by phenomena that students are likely to encounter in their careers, involving biomechanics, heat-transfer, structural analysis, control theory, fluid-flow, electrical conduction, diffusion, etc. This will help students develop intuition about the strengths and weaknesses of a variety of modeling & numerical methods, as well as develop intuition about modeling physical systems & strengths and weaknesses of a variety of numerical methods, including: Discretization of differential equations, Methods for solving nonlinear systems, Gradient-based methods and machine learning algorithms for optimization, stats & quantification

Basic Modeling and Simulation Tools for Industrial Research

Applications: Read More [+]

### Rules & Requirements

**Prerequisites:** ENGIN 7 or COMPSCI 61A, PHYSICS 7A, MATH 53, and MATH 54

**Credit Restrictions:** Students will receive no credit for ENGIN 150 after completing ENGIN 150. A deficient grade in ENGIN 150 may be removed by taking ENGIN 150.

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

Basic Modeling and Simulation Tools for Industrial Research

Applications: Read Less [-]

## ENGIN 151 Modeling and Simulation of Infectious Diseases 3 Units

Terms offered: Prior to 2007

The course emphasizes elementary modeling, numerical methods and their implementation on physical problems motivated by real-world phenomena involving various aspects of infection diseases. This course is broken into five parts: part 1-modeling and simulation of the infection zone from respiratory emission, part 2-rapid simulation of viral decontamination efficacy with uv irradiation, part 3-an agent-based computational framework for simulation of global pandemic and social response, part 4-machine learning and parameter identification, part 5-deep dive into advanced models: continuum mechanics, solid-fluid interaction and electromagnetism.

Modeling and Simulation of Infectious Diseases: [Read More](#) [+]

### Objectives & Outcomes

**Course Objectives:** Comprised of an introduction to essential mathematical modeling and simulation tools needed for various aspects of the modeling and simulation of infectious diseases. Six capstone projects, drawn from Parts 1-5 are assigned, applying the modeling and simulation tools.

### Rules & Requirements

**Prerequisites:** ENGIN 7, COMPSCI 61A, or DATA C8 + COMPSCI 88; and PHYSICS 7A; and MATH 53 AND MATH 54

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructor:** Tarek Zohdi

Modeling and Simulation of Infectious Diseases: [Read Less](#) [-]

## ENGIN 157AC Engineering, The Environment, and Society 4 Units

Terms offered: Spring 2023, Spring 2022, Spring 2021

This course engages students at the intersection of environmental justice, social justice, and engineering to explore how problems that are commonly defined in technical terms are at their roots deeply socially embedded. Through partnerships with community-based organizations, students are trained to recognize the socio-political nature of technical problems so that they may approach solutions in ways that prioritize social justice. Topics covered include environmental engineering as it relates to air, water, and soil contamination; race, class, and privilege; expertise; ethics; and engaged citizenship. This course cannot be used to complete any engineering technical unit requirements.

Engineering, The Environment, and Society: [Read More](#) [+]

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture and 1 hour of discussion per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Alternative to final exam.

**Also listed as:** IAS 157AC

Engineering, The Environment, and Society: [Read Less](#) [-]

## ENGIN 177 Advanced Programming with MATLAB 3 Units

Terms offered: Spring 2017, Spring 2015, Spring 2014

The course builds an understanding, demonstrates engineering uses, and provides hand-on experience for object-oriented programming as well as exposes a practical knowledge of advanced features available in MATLAB. The course will begin with a brief review of basic MATLAB features and quickly move to class organization and functionality. The introduced concepts are reinforced by examining the advanced graphical features of MATLAB. The material will also include the effective use of programs written in C and FORTRAN, and will cover SIMULINK, a MATLAB toolbox providing for an effective ways of model simulations. Throughout the course, the emphasis will be placed on examples and homework assignments from engineering disciplines.

Advanced Programming with MATLAB: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** ENGIN 7, MATH 53 and MATH 54 (one of these math courses may be taken concurrently)

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructors:** Frenklach, Packard

Advanced Programming with MATLAB: [Read Less](#) [-]

## ENGIN 178 Statistics and Data Science for Engineers 4 Units

Terms offered: Spring 2023, Fall 2022, Spring 2022

This course provides a foundation in data science with emphasis on the application of statistics and machine learning to engineering problems.

The course combines theoretical topics in probability and statistical inference with practical methods for solving problems in code. Each topic is demonstrated with examples from engineering. These include hypothesis testing, principal component analysis, clustering, linear regression, time series analysis, classification, and deep learning. Math 53 and 54 are recommended before Engin 178, Math 53 and 54 are allowed concurrently.

Statistics and Data Science for Engineers: Read More [+]

### Objectives & Outcomes

**Course Objectives:** To demonstrate the use of data science in engineering tasks.

To enable students to import, clean, visualize, and interpret data sets using modern computer languages.

To familiarize students with a range of techniques for building models from data.

To introduce the concepts of quantitative statistics and probability.

To provide a theoretical and conceptual basis for students to understand the role of data in engineering.

To teach students how to build and train machine learning models.

**Student Learning Outcomes:** A knowledge of contemporary issues. An ability to apply knowledge of mathematics, science, and engineering. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

An ability to design and conduct experiments, as well as to analyze and interpret data.

An ability to identify, formulate, and solve engineering problems.

An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

### Rules & Requirements

**Prerequisites:** ENGIN 7, MATH 1A, MATH 1B MATH 53, and MATH 54 (may be taken concurrently)

**Credit Restrictions:** Students will receive no credit for ENGIN 178 after completing ENGIN 78. A deficient grade in ENGIN 178 may be removed by taking ENGIN 78.

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture and 2 hours of laboratory per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructor:** Papadopoulos

Statistics and Data Science for Engineers: Read Less [-]

## ENGIN 180 Preparing for the Fields and Jobs of the Future 3 Units

Terms offered: Spring 2018

The course is concerned with giving students the tools to prepare for the fields and jobs of the future.

Across all university departments and majors, the numbers of students who do not work in the fields in which they've received their degrees is not only significant, but growing. For example, anywhere from 20-40% of STEM graduates do not work in the fields in which they received their degrees.

This does not mean that students shouldn't major in STEM, but that one of the primary purposes of higher education is learning how to learn.

Accordingly, this course presents a number of frameworks that are critical for thinking about that which has not yet been invented.

Preparing for the Fields and Jobs of the Future: Read More [+]

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Alternate method of final assessment during regularly scheduled final exam group (e.g., presentation, final project, etc.).

**Instructor:** Ian I. Mitroff

Preparing for the Fields and Jobs of the Future: Read Less [-]

## ENGIN 183 Special Topics in Technology Innovation and Entrepreneurship 1 - 4 Units

Terms offered: Spring 2023, Fall 2022

This course will explore various topics around technology innovation and entrepreneurship. Topics will vary by semester.

Special Topics in Technology Innovation and Entrepreneurship: Read More [+]

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 1-4 hours of seminar per week

### Summer:

6 weeks - 2.5-10 hours of seminar per week

8 weeks - 1.5-7.5 hours of seminar per week

10 weeks - 1.5-6 hours of seminar per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Formerly known as:** Industrial Engin and Oper Research 190E

Special Topics in Technology Innovation and Entrepreneurship: Read Less [-]

## ENGIN 183A A. Richard Newton Lecture Series 1 Unit

Terms offered: Spring 2023, Fall 2022

This lecture series serves as an entry point for undergraduate and graduate curriculum sequences in entrepreneurship and innovation. The series, established in 2005, is named in honor of A. Richard Newton, a visionary technology industry leader and late dean of the University of California Berkeley College of Engineering. The course features a selection of high-level industry speakers who share their insights on industry developments, leadership, and innovation based on their careers.

A. Richard Newton Lecture Series: [Read More](#) [+]

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 1.5 hours of colloquium per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Offered for pass/not pass grade only. Alternative to final exam.

**Formerly known as:** Industrial Engin and Oper Research 195

A. Richard Newton Lecture Series: [Read Less](#) [-]

## ENGIN 183B Berkeley Method of Entrepreneurship Bootcamp 2 Units

Terms offered: Spring 2023, Fall 2022

This course offers the opportunity to understand the Berkeley Method of Entrepreneurship (BME) in an intensive format. The BME curriculum conveys the latest approaches for training global technology entrepreneurs. This method leverages insights on strategy, tactics, culture, and psychology with an accompanying entrepreneurial infrastructure. The curriculum is structured to provide an optimal global entrepreneurship experience from real life experiences.

Berkeley Method of Entrepreneurship Bootcamp: [Read More](#) [+]

### Objectives & Outcomes

**Course Objectives:** \* To understand and make use of the value of diversity in idea generation and new venture creation.

Student should become aware of the infrastructure available through UC Berkeley that can support them in developing new ventures.

To understand common tactics in starting new ventures including a lean learning cycle.

To understand the mindset of an entrepreneur, including the soft skills, behaviors, and psychological factors most likely to be needed to develop a new venture.

**Student Learning Outcomes:** Students should be able to consider a greater number of ideas for global entrepreneurship by observing the effect of background diversity in the class.

Students should be able to follow a process of idea generation, rapid prototyping / venture story development, attraction of stakeholders, data collection, and hypothesis testing and regeneration.

Students should become aware of the mindset and behaviour required for entrepreneurship and be able to reinforce some of these behaviours (eg rejection tolerance, comfort with failing or being wrong, inductive learning, venture story telling/communication abilities) through exercises in the program.

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit with instructor consent.

### Hours & Format

**Fall and/or spring:** 1 weeks - 30 hours of lecture and 20 hours of discussion per week

**Summer:** 1 weeks - 30 hours of lecture and 20 hours of discussion per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Alternative to final exam.

**Formerly known as:** Industrial Engin and Oper Research 192

Berkeley Method of Entrepreneurship Bootcamp: [Read Less](#) [-]

## ENGIN 183C Challenge Lab 4 Units

Terms offered: Spring 2023, Fall 2022

This course is meant for students in engineering and other disciplines who seek a challenging, interactive, team-based, and hands-on learning experience in entrepreneurship and technology. In this highly experiential course, students work in simulated start-up teams to create products or start-up ideas to address a broadly-defined need of an industry partner or social challenge.

Challenge Lab: Read More [+]

### Objectives & Outcomes

#### Course Objectives: 1)

To catalyze learning through experiential entrepreneurship

2)

To help students understand the entrepreneurial context, and how it can create better outcomes.

3)

To help students identify the best role for themselves within an entrepreneurial organization.

#### Student Learning Outcomes: 1)

Gain experience with effectively refining ideas and pivoting based on feedback and external factors.

2)

Gain experience building effective teams to develop and execute an idea

3)

Become comfortable with failure and how to learn from failure.

4)

Become adept at succinctly communicating ideas in terms of value proposition and business viability.

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit when topic changes.

### Hours & Format

**Fall and/or spring:** 15 weeks - 4 hours of seminar per week

#### Summer:

6 weeks - 10 hours of seminar per week

8 weeks - 7.5 hours of seminar per week

10 weeks - 6 hours of seminar per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Alternative to final exam.

**Formerly known as:** Industrial Engin and Oper Research 185

Challenge Lab: Read Less [-]

## ENGIN 183D Product Management 3 Units

Terms offered: Spring 2023, Fall 2022

Too often we are enamored in our brilliant ideas, we skip the most important part: building products consumers will want and use. Precious time and effort is wasted on engineering perfect products only to launch to no users. This course teaches product management skills such as attributes of great product managers, reducing risk and cost while accelerating time to market, product life cycle, stakeholder management and effective development processes.

Product Management: Read More [+]

### Objectives & Outcomes

#### Course Objectives: •

Students will experience a live development of a product within the context of a product development process.

•

Students will learn common methods used in product management

•

Students will understand the difference between engineering design and product development as a process commonly used in new venture environments.

#### Student Learning Outcomes: •

Students will actually develop a real world functioning product, to be described as Minimum Viable.

•

Students will be able to manage a product development process that leads to a product that is technically feasible as well as desired by customers.

•

Students will gain experience needed to work as product managers in real life environments.

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of seminar per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Alternative to final exam.

**Formerly known as:** Industrial Engin and Oper Research 186

Product Management: Read Less [-]



## ENGIN 183E Technology Entrepreneurship 3 Units

Terms offered: Spring 2023, Fall 2022

This course explores key entrepreneurial concepts relevant to the high-technology world. Topics include the entrepreneurial perspective, start-up strategies, business idea evaluation, business plan writing, introduction to entrepreneurial finance and venture capital, managing growth, and delivering innovative products. This course prepares technical and business minded students for careers focused on entrepreneurship, intrapreneurship, and high technology. Students undertake intensive study of actual business situations through rigorous case-study analysis. This course can not be used to fulfill any engineering requirement (engineering units, courses, technical electives, or otherwise).

Technology Entrepreneurship: Read More [+]

### Rules & Requirements

**Prerequisites:** Junior or senior standing

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Alternative to final exam.

**Formerly known as:** Industrial Engin and Oper Research 191

Technology Entrepreneurship: Read Less [-]

## ENGIN 185 The Art of STEM Communication 3 Units

Terms offered: Spring 2023, Spring 2022, Fall 2021

This course provides engineering majors with the fundamental skills for effective technical communication. During the course of the semester, students will develop communications for public dissemination, covering a project or initiative within UC Berkeley's College of Engineering. This work will call on students to: (a) cultivate interest in a broad range of topics related to Engineering; (b) become an engaged and critical reader of academic and general-interest science publications; (c) learn how to assess, plan for, and respond to a variety of communicative situations; (d) produce focused, and at the same time, narratively-rich, accounts of Engineering research.

The Art of STEM Communication: Read More [+]

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Alternate method of final assessment during regularly scheduled final exam group (e.g., presentation, final project, etc.).

The Art of STEM Communication: Read Less [-]

## ENGIN 187 Global Engineering: The Challenges of Globalization and Disruptive Innovation 1 or 2 Units

Terms offered: Fall 2019

The course examines the challenges of innovation beyond new technology development: from the challenges of global expansion, to the issues of unintended consequences of technology and the ability of technology to support or hinder social justice. The course will provide examples in a variety of global locations (e.g., Latin America, Southeast Asia, Africa, China, and India), utilizing case examples (written and presented by speakers) that illustrate the challenges faced in a range of fields of engineering and technology, from water and transportation to information and communications technology, and from start-ups to major corporations, government entities, and policy makers.

Global Engineering: The Challenges of Globalization and Disruptive Innovation: Read More [+]

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit when topic changes.

### Hours & Format

**Fall and/or spring:** 8 weeks - 2-4 hours of lecture per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Alternative to final exam.

Global Engineering: The Challenges of Globalization and Disruptive Innovation: Read Less [-]

## ENGIN 194 Undergraduate Research 3 Units

Terms offered: Spring 2023, Fall 2022, Spring 2022

Students who have completed a satisfactory number of advanced courses may pursue original research under the direction of one of the members of the staff. Final report and presentation required.

Undergraduate Research: Read More [+]

### Rules & Requirements

**Prerequisites:** Consent of instructor and adviser, junior or senior standing

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 0 hours of independent study per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

Undergraduate Research: Read Less [-]

## ENGIN 195A Engineering Science Senior Thesis Research 1 - 3 Units

Terms offered: Fall 2022

Thesis work under the supervision of a faculty member. To obtain full credit, the student must submit a satisfactory thesis at the end of two semesters of research. A total of four units must be taken. The units must be distributed between the two semesters (2 units in E195A and 2 units in E195B, or 1+3 or 3+1). Note, completion of a senior thesis does not contribute toward graduation requirements.

Engineering Science Senior Thesis Research: [Read More](#) [+]

### Objectives & Outcomes

**Course Objectives:** Gain experience conducting an independent research project in science and/or engineering.

Report research outcomes in a written thesis.

**Student Learning Outcomes:** Develop familiarity reading scientific literature

Gain expertise in a field closely related to their coursework

Gain practice asking research questions and managing an independent project

Learn how to communicate scientific ideas and methods in a research thesis

Practice good teamwork with their fellow research students and their supervisor

### Rules & Requirements

**Prerequisites:** Must be an Engineering Science student with senior standing, with one fall and one spring semester remaining, and an overall UC GPA of at least 3.3

### Hours & Format

**Fall and/or spring:** 15 weeks - 3-9 hours of independent study per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Offered for pass/not pass grade only. Final exam not required.

Engineering Science Senior Thesis Research: [Read Less](#) [-]

## ENGIN 195B Engineering Science Senior Thesis Research 1 - 3 Units

Terms offered: Spring 2023

Thesis work under the supervision of a faculty member. To obtain full credit, the student must submit a satisfactory thesis at the end of two semesters of research. A total of four units must be taken. The units must be distributed between the two semesters (2 units in E195A and 2 units in E195B, or 1+3 or 3+1). Note, completion of a senior thesis does not contribute toward graduation requirements.

Engineering Science Senior Thesis Research: [Read More](#) [+]

### Objectives & Outcomes

**Course Objectives:** Gain experience conducting an independent research project in science and/or engineering.

Report research outcomes in a written thesis.

**Student Learning Outcomes:** Develop familiarity reading scientific literature

Gain expertise in a field closely related to their coursework

Gain practice asking research questions and managing an independent project

Learn how to communicate scientific ideas and methods in a research thesis

Practice good teamwork with their fellow research students and their supervisor

### Rules & Requirements

**Prerequisites:** Must be an Engineering Science student with senior standing, with one fall and one spring semester remaining, and an overall UC GPA of at least 3.3

### Hours & Format

**Fall and/or spring:** 15 weeks - 3-9 hours of independent study per week

### Additional Details

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Offered for pass/not pass grade only. Final exam not required.

Engineering Science Senior Thesis Research: [Read Less](#) [-]

## **ENGIN 198 Directed Group Studies for Advanced Undergraduates 1 - 4 Units**

Terms offered: Spring 2023, Fall 2022, Spring 2022

Group study of selected topics.

Directed Group Studies for Advanced Undergraduates: [Read More \[+\]](#)

### **Rules & Requirements**

**Prerequisites:** Upper division standing, plus particular courses to be specified by instructor

**Repeat rules:** Course may be repeated for credit without restriction.

### **Hours & Format**

**Fall and/or spring:** 15 weeks - 1-4 hours of directed group study per week

**Summer:** 8 weeks - 1.5-7.5 hours of directed group study per week

### **Additional Details**

**Subject/Course Level:** Engineering/Undergraduate

**Grading/Final exam status:** Offered for pass/not pass grade only. Final exam not required.

Directed Group Studies for Advanced Undergraduates: [Read Less \[-\]](#)